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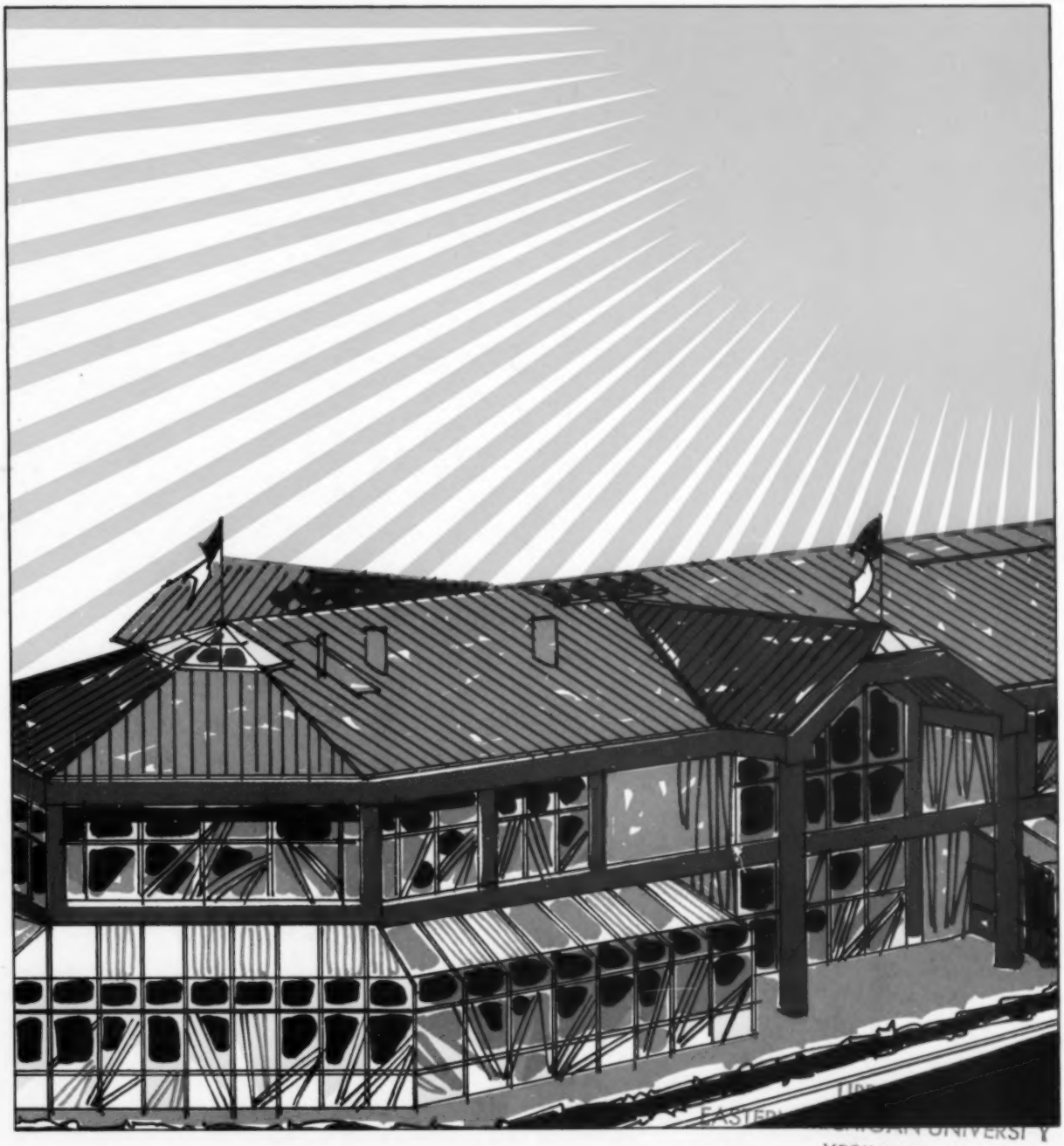
The magazine of the National Bureau of Standards U.S. Department of Commerce

August 1980



USING NATURAL ILLUMINATION. See page 7.

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COMMENT

ASIAN AFFAIRS

In May 1979, a Protocol for cooperation was completed between the U.S. Department of Commerce and the State Bureau of Metrology, People's Republic of China. One article of this Protocol proposed an exchange of visits between the Director of the National Bureau of Standards and the State Bureau of Metrology. Therefore, I went to China just a few months ago.

I was impressed by the Chinese desire to increase their productive capacity and by their eagerness to benefit from western experience in the fields of metrology and standardization. They are determined to build the institutions and competence needed by an expanding economy, and we at NBS will assist where we can under the Protocol.

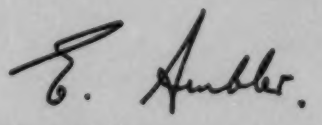
The Protocol also calls for scientific exchanges between our institutions, and we now have three colleagues from China on extended assignments at NBS. Several NBS people have visited and lectured in China, and a larger contingent is scheduled to go this fall. These exchanges will build the personal relationships that are crucial to the effective flow of information and ideas. I envision, and welcome, a long and productive relationship with the State Bureau of Metrology.

I also visited a number of industrial and government laboratories in Korea, most importantly the Korea Standards Research Institute. This Institute is a new organization which provides essential measurement services to the Korean industrial and academic community. Nearly 50 people from the Institute staff have been to NBS for extended orientations and training, and we are proud of our role in helping the Institute grow from concept to reality.

But I am particularly anxious to share with you my impressions of Japan. Even my preconceptions of this dynamic society did not prepare me for the impact of a first-hand visit. The Japanese are a confident, hard-working, highly-organized, very productive people. If I had to characterize Japan with one word, it would be *focused*. They have a marvelous capacity to determine what they would like to achieve, and then to marshall the technical, productive, and institutional forces needed to reach that goal. Cooperation between government and industry, and between management and labor, is a key ingredient in their accomplishments.

Japanese skill in adapting and improving upon foreign technology has been a major factor in their industrial success. Those days are over, according to the leaders of Japanese industry and government, because they have carried the process as far as they can. They told me that to remain competitive their emphasis must encompass the creation of new technologies, as well as their exploitation. I believe Japan will make this transition and will remain a vital force in the global economy.

We Americans need to accept the challenge posed by the Japanese in a spirit of friendly but determined rivalry. We *must*, economically, and we *should*, because of its appeal to the American spirit of competition. We must recognize the tremendous job done by the Japanese and resolve to meet them on equal terms in the world marketplace.



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DIMENSIONS NBS

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ROLE OF WEIGHTS AND MEASURES

THIS text has been edited and excerpted from a keynote address by Dr. Louis S. Meyer, Director, Conference of Consumer Organizations, and member of the faculty of Edinboro State College, Pennsylvania. It was addressed to the 65th National Conference on Weights and Measures (NCWM), June 25, 1980, in Washington, D.C. We believe it will be of general interest to our readers.

I would like to suggest to the National Conference on Weights and Measures several significant issues that numerous consumer representatives and advocates believe will affect the marketplace in the decade ahead. I will then turn to a few concerns relating to weights and measures as viewed by these representatives.

It is very important that the *broad* marketplace issues should be identified, whether or not they are directly related to weights and measures, because every agency, company, profession, occupation, or industry must recognize that it cannot withdraw into its own arena of operation and neglect other peripheral problems that impact on the marketplace.

For too long, too many people have contented themselves with thinking that the "other problem" belongs to someone else to solve. For too long, Government agencies, industry, and a wide variety of occupations and professions have been satisfied to think that only the utility company, the airline, the supermarket chain, the auto repair shop or service station, or the local medical center need be given consideration in regard to testifying at hearings on legislation and regulation affecting those entities. This type of thinking results from the feeling that the consumer, the public, knows little about such matters as utility rates and nuclear power; about airline schedules, lost baggage, and overbooking of flights; about the Universal Product Code, or the direct correlation between high food advertising costs and the nutritional worthlessness of the commodity, or the short-weighing of produce.

Historically there has been an attitude quite rampant across this land that the general public, the consumer, does not know and doesn't really have the *right* to know; that this right is conferred upon the government official, the political appointee, the corporate executive, and the professionals in our economic system. These are the ones to whom we must supposedly defer.

I am suggesting to you that this decades-old policy and belief that the system can harbor a business-as-usual attitude is as outdated as believing that we can fight metric and win. The fact of the matter is that nobody here can rest assured that he or she is exempt from assisting in the solution of marketplace issues that transcend the area of weights and measures.

Just as some American corporations, trade associations, and industries are already being drawn into joint decision-making structures between themselves and consumers, so, indeed, shall occupations and professions come to realize that they must sit down with public or consumer representatives—those who work with consumer groups and have a bonafide constituency—early-on in the game and identify the issues and the problems that must be resolved.

There are those who will disagree and fight this idea. So be it. If confrontation, adversarial relationships, or unreasonable attitudes are what such people desire, I am sure there are those from within the public sector who will accommodate such feelings. For one, I believe such a course of action will only aggravate the problems that are plaguing the marketplace today.

What does all of this mean to you as public officials and others in the private sector involved in weights and measures? I suggest to you that you must become aware, if you are not already so, of what is bothering consumers as we enter the 1980's. This means that you must be attuned to the issues that are being identified by consumer representatives as the key problems likely to surface in the months and years ahead. I do not—and I emphasize—I do not mean only those issues that relate directly to your occupation or profession, but rather the many others that are outside your jurisdiction or seem to be today. The interrelationship of direct and indirect issues must be recognized if the problems are to be resolved, irrespective of the difficulty in confronting such issues.

The issues to which I allude are such things as the low-income consumer and how low-income consumers for the most part have been bypassed in the marketplace; prospective changes that are affecting our health-care system; energy policies as they impact on consumer interests; the consumer stake in regulatory reform; the impact of multinational corporations on consumer interests; the long-term effect of the computerized scanner and the Universal Product Code in the supermarket; the alternative marketing systems being established across the country and their implications; the move to metric and how it can negatively affect consumers unless we make ourselves aware of the potential problems. Of course, there are other select issues that you are aware of and that I may not be aware of, but in the process let us recognize how weights and measures

An official checks weight of item in the marketplace.

may be a part of these issues, as remote as it may now seem.

How do you come to understand the issues? First, I believe, by making yourselves openly available to consumer groups in your states and communities. I think in all sectors we must involve those who are affected by our activities. We must talk less to and among ourselves and make a greater effort to talk to others, in spite of the fact that many weights and measures operations and offices are understaffed and ill-equipped to do the job entrusted to them decades ago—all the more reason to make contact with public interest groups in our communities.

I think the pertinent question is, when was the last time you moved out of your State or local office and sought out consumer groups to discuss what they viewed as problems in the weights and measures arena? I would like to believe that it happened last week, but I'm afraid that in most instances it didn't happen at all.

And I might add, why not? When we talk to industry representatives, why not discuss with them the possibility of *their* getting out and talking to people within their communities, to community action agency staff people, and to consumer groups. Find out what their problems are. My point is that you have natural allegiances with concerned consumers and public interest groups, and alliances and coalitions can be built upon them. I know of no other matter so compelling in the decade ahead, to help in solving marketplace problems, as this need to establish public dialogue and to get input from other quarters as well as from within your own organizations.

One way toward better understanding of the issues is attendance at consumer conferences and workshops. Consumer representatives are important adjuncts to meetings such as this, but they need financial assistance to get here. I strongly urge the Department of Commerce to undertake an examination of prospective ways by which greater consumer input can be obtained at conferences like this. Particularly, in cases where revamping or amending of State laws are being considered, preamendment meetings could very well be held with consumer sector representation. Just as more and more we are having pre-rate-filing conferences with utility companies before a new rate filing is sent to the public utility commission or the public service commission of the various States.

Let me turn now to a few concerns that consumer representatives have about weights and measures. Foremost is the absolute necessity for weights and measures investigators and other officials to view themselves strongly and affirmatively as consumer protection people. It is all well and good to recognize weights and measures as the oldest consumer protection profession, but it is something else to operate and respond as such on a day-to-day basis in the marketplace.

In order to operate effectively and in the consumer's best interests, weights and measures must be taken out of politics. This leads to many things, such as prohibitions against the wearing of campaign buttons, either while enforcing weights and measures laws or while attending conferences where the hospitality room is stocked by local merchants who are subject to weights and measures inspections. While I realize that many inspectors and other local and State officials will strongly deny any consideration of political ramifications in their jobs, the evidence is adequately strong to point up the need to develop a professionally trained cadre of weights and measures inspectors, sealers, and other officials.

The time is at hand when Federal training of inspectors should be considered, including the required technical training, utilization of textbooks, and facilities. This means that a major part of weights and

measures training should be standardized across the country. At the present time the professionalism of weights and measures officials varies widely. In some States, the tradition is solid, and the performance is good. Law enforcement is handled well; complaint handling is also good. In other States, the reverse is true—inspectors have little knowledge as to how to swear out a citation, little prepackage checking is done, poor equipment is used, and there are many other problems. Granted, as pointed out to me by one consumer activist, much of the problem stems from county operations as contrasted to State operations, but considering the sophistication of coming technological needs, many questions have been raised as to the capability of counties, except in some circumstances, to handle weights and measures responsibilities.

Closely related to this is the need to re-examine the old adage--"that government is best that is closest to the people." I am not suggesting for a minute that the Federal bureaucracy is the cure-all for our extensive list of societal ills, but I think there are questions to raise about the interaction of business (at the local level) and weights and measures enforcement. If you question the idea, I suggest you examine the extent to which local zoning has become a marketable commodity. We are close to our neighbors and local public officials, and that closeness can often breed questionable decision-making. It is simply a fact of economic, social, and political life, and something we have to guard against very carefully.

Likewise, consumers are concerned about the enforcement of weights and measures laws in locations that are not established places of business. I refer to such operations as the sale of cord wood, where the commodity is sold in every non-legal quantity known to man. Such transactions are elusive to track down, and the consumer can be taken by a slick operator. Also, this kind of sale will become increasingly important as wood is utilized in greater quantities by consumers in the years ahead.

There is a strong awareness among consumerists that much of what is needed would be found—as I mentioned previously—in specialized training programs for State inspectors, eliminating State and county duplication where it exists. It may also mean a form of civil service operation that, to a large extent, is removed from politics. As another consumer activist once emphasized to me—"Numbers one to five on my list of priorities for what should be done in the areas of weights and measures in the decade ahead are Federal Government training of

Top. The Universal Product Code Scanner.
Bottom. Checking out—now a fast, simple process.

inspectors with the personnel becoming civil servants. The real experts, the facilities, and the programming capabilities are there, and they should be utilized to their fullest extent if weights and measures are to provide the consumer protection intended."

The decade ahead is going to bring new technologies in many areas affecting consumers. These will demand increasing competencies and expertise, with greater expectations on the part of consumers for greater uniformity and consistency in enforcement policies and practices. It is going to create the need for extensive educational programs, formal and informal, within and outside the land grant college and university system, to assist consumers in better understanding these technologies.

Another consideration is, what are the laws in any particular State and what can the consumer do about the problems that affect weights and measures? In most instances, consumers have no idea what they can or should do. The average consumer knows very little about what is allowable and what isn't. And I think part of our problem, part of our responsibility, is to see to it that this educational and informational kind of operation brings the consumer into the kinds of things that the weights and measures officials are doing.

So I must go back to the beginning—as Lewis Carroll said in *Alice in Wonderland*, "the place to begin is at the beginning"—and after almost five years of

Left. Dr. Louis S. Meyer, speaker at National Conference of Weights and Measures (NCWM). Right. NCWM in session.

joint dialogue with various companies and industries and people in the consumer sector, I am convinced that we begin the solution of problems in the 1980's by recognizing the tremendous public marketplace responsibilities of those involved in weights and measures. Your budgets and legislative regulatory capabilities will need to be strengthened in the months ahead. There will be needs that can draw from coalition building within the communities and States. Support is there, but it's up to everyone in this room to seek it out, and I refer to public support to bring the obligations and responsibilities of weights and measures to the forefront of consumer protection where it belongs.

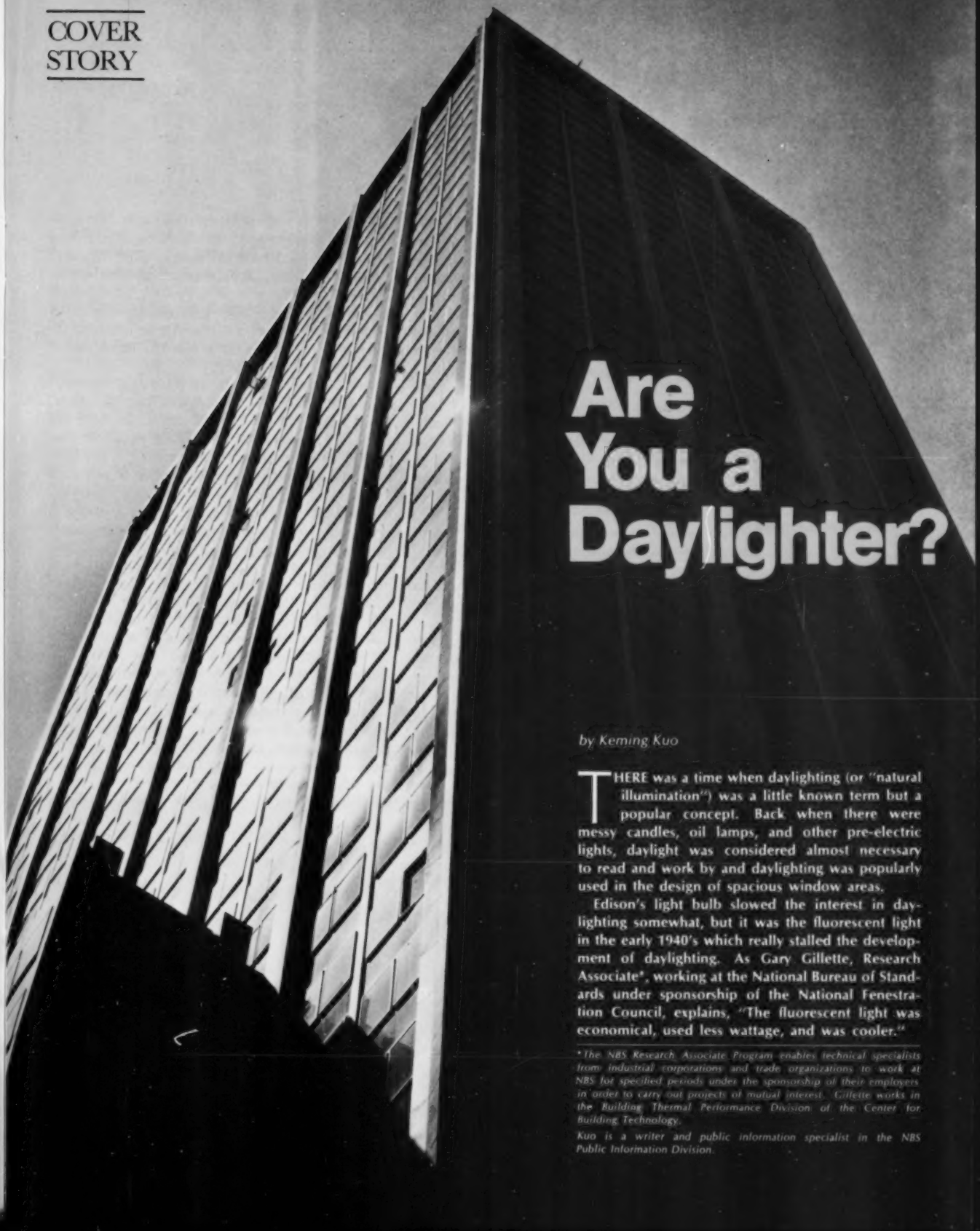
It won't be easy, breaking some of the old molds and creating some new ones. But the marketplace is changing, and it's changing very significantly. That is what we will witness in the decade of the 1980's, the decade of the marketplace. It will mean greater consumer awareness, sophistication, and, yes, at times, demands, but it will also bring about a greater appreciation and recognition on the part of business and industry of what is meant by societal responsibilities, and the acceptance of such responsibilities. More and more corporate types are realizing that the corporate franchise was somehow not ordained by God for their benefit, but rather recognizing that it was granted by the people for the ultimate benefit of the people.

Easy or not, this job must be done, for to do otherwise will mean the court of last resort for the consumer—regulatory and legislative action.

It is your choice. Indeed, it is *our* choice, to do the job that needs doing, to protect the consumer public.

It may mean rocking the boat a bit, but it won't be the first time that competent public officials were accused of that. Eighty-five years ago, Colorado produced a public official whom some of you may recall, the great populist, Mary E. Lease, who, during some very trying times, said that what this country needs is to raise more hell and less corn. And I believe she was right. But it must be effective hell-raising, by committed and knowledgeable people who understand the issues and do not worry about creating a few waves. It cannot be left to others. It must be our concern to effect a positive public interest change in the next decade, and do it in the months to come as we interest and re-interest people—consumers—in the vitality and the historic responsibility of the mission of weights and measures. □

COVER STORY



Are You a Daylighter?

by Keming Kuo

THERE was a time when daylighting (or "natural illumination") was a little known term but a popular concept. Back when there were messy candles, oil lamps, and other pre-electric lights, daylight was considered almost necessary to read and work by and daylighting was popularly used in the design of spacious window areas.

Edison's light bulb slowed the interest in daylighting somewhat, but it was the fluorescent light in the early 1940's which really stalled the development of daylighting. As Gary Gillette, Research Associate*, working at the National Bureau of Standards under sponsorship of the National Fenestration Council, explains, "The fluorescent light was economical, used less wattage, and was cooler."

**The NBS Research Associate Program enables technical specialists from industrial corporations and trade organizations to work at NBS for specified periods under the sponsorship of their employers in order to carry out projects of mutual interest. Gillette works in the Building Thermal Performance Division of the Center for Building Technology.*

Kuo is a writer and public information specialist in the NBS Public Information Division.

In the next few decades, fluorescent lights seemed to clone themselves over the ceilings of every office, corridor, and classroom. Still other design changes came about in the 1950's and 1960's to offset the advantages of daylighting. Many American building designers, Gillette says, insisted that significant building cost savings could be realized by lowering ceiling heights and designing deeper rooms. But the increased usable floor area with reduced "perimeter, enclosure surface" (the glass "skin" or outer layer of a building) meant fewer daylighting design possibilities and a greater reliance on electric lighting and mechanical cooling systems. What's more, windows were now being sealed to maintain constant air pressures and cause less strain on the building's heating/cooling systems. Windows were for the view.

Then came the energy-short 1970's. The idea of daylighting—like several other energy-saving ideas—sparked a resurgence of interest among builders. Can daylighting really help save energy? And do those savings offset any extra building costs incurred by incorporating daylighting concepts?

Gillette is working on the first question and preliminary indications are that daylighting is indeed a useful energy-saving technique. He is preparing a versatile computer program which will allow architects, builders, designers, and engineers to evaluate the overall energy performance of building designs (heating, cooling, ventilating, and lighting systems) that incorporate daylighting. Once the program is finished, an architect can plug a wide variety of data into Gillette's program to determine whether a daylighting design would be more energy efficient than a traditional design. The computer program can evaluate increased nighttime winter heat loss and daytime summer heat gain against decreased lighting energy requirements offered by daylighting. For example, would it be more advantageous to use a long bank of windows or sets of narrow "slits" in "Building X"?

Gillette's current computer work is a continuation of his research at Pennsylvania State University. There, he chose a nearby high school classroom and calculated its energy load in relation to various daylighting characteristics. He estimated that daylighting could provide energy savings of up to one-third (based on a nine-month school year, Sept-May) compared to traditional electric lighting practices.

Not only will the computer program be an important tool for the design community, it is also intended to be incorporated into the "DOE II" computer program—a major part of the Department of Energy's Building Energy Performance Standards (BEPS). BEPS, a set of proposed Federal guidelines, would set ceilings on the amount of energy a new building is designed to consume.

Although BEPS will apply to all new construction, both residential and commercial, daylighting is most applicable to commercial usage since few lights are used in homes during the day. Office studies, however, have shown that lighting often accounts for more than 50 percent of a building's energy load, and it also increases cooling requirements. "In a

Left. Fluorescent lights in corridor—wasted energy

Right. Use of daylighting in business building.

few cases, the lights are used as a heat source," Gillette says, "but for most large buildings—especially high-rise—the internal heat build-up is so great that the heat gain from the lights is not beneficial, even in winter." For offices and other commercial buildings, outdoor temperature has a smaller effect on indoor heating/cooling costs than does the mechanical system and the internal heat from people, lights, computers, and other equipment. Thus, daylighting can be very favorable since it reduces the required electric lighting energy and the extra heat from the lights.

Referring to the energy consumption model, Gillette explains that there are many factors to be considered. For convenience, these may be placed in three groups:

- time/nature: local outdoor illumination, which depends upon the weather (sunny/cloudy, humidity, temperature), time of the day, and season.
- site: building orientation, geographical latitude, building and tree obstructions, ground cover (snow/sand or absorbent earth/grass), and pollution (which blocks light in the atmosphere and dirties windows).
- room/building: areas of windows and skylights (glazing), room/building occupants and contents, ceiling height, user distance from glazing, and the control of the supplemental electric lighting.

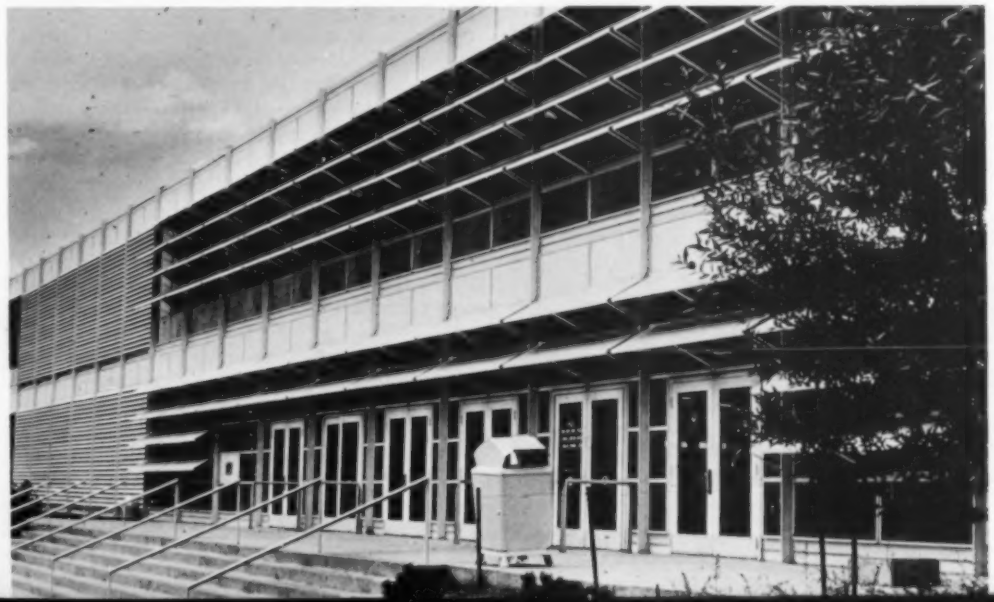
Solar Energy

Mention solar energy and the mind conjures up massive arrays of solar collectors, briny fluids gurgling through hot water heaters, or photovoltaic panels perched on a building like violet wings on a satellite.

But what about those rays bouncing off this magazine—if you're reading it near a sunlit window?

Right. The light of Old Sol—in addition to being heat—is solar energy.

Unfortunately, no local outdoor daylight data (amount of light available daily including weather effects) were available. The dearth of data has prompted Gillette to work on a mathematical model which would allow researchers and designers to predict such daylight data for many areas of the country. Weather tape data, including cloud cover or solar radiation information, may then be fed into the model's formula to determine localized daylight



Metal sunshades provide ambient lighting for college library.

availability. New information is currently being gathered at a site adjacent to the NBS grounds in Gaithersburg, Md. The daylight availability model should be ready within six months to a year, Gillette says.

The influence of weather on daylighting effectiveness brings up the question of quality of light in addition to its quantity. "Overcast days are generally more useful for daylighting than bright, sunny days," Gillette points out. "The color rendition of the overcast day is better (the light is very white—not too yellow and not too blue), and the light is diffuse and almost shadowless. Remember what it's like to read in direct sunlight? It's not very comfortable."

In areas where direct sunlight is more common—such as the U.S. Southwest—various optical and mechanical means have been devised to provide the softer, ambient lighting. These include the use of overhangs, louvres, shades, curtains, Venetian blinds, prismatic and tinted glass, clerestories, trellises, and reflectors. Of course, as noted earlier, these materials add to costs. Some of these devices may be used in conjunction with artificial lighting in a design technique called task-ambient lighting.

A subject of interest to NBS researchers, task-ambient lighting design emphasizes the use of local lighting in specific task areas to augment general (ambient) lighting. Instead of using overpowering ceiling lights, task-ambient lighting designs utilize small, desk lamps close to the user's work task and low level diffuse lighting as ambient, general lighting. Gillette says that while task-ambient lighting designs using all-artificial lighting can also be energy conserving, their application seems particularly suitable if supplemented with daylight (creating a mix of local work light and diffuse general natural light). And, after using Gillette's computer program to compare the estimated energy loads from task-ambient designs with traditional ones, an architect will probably find that the task-ambient concept will help keep a building's projected energy use well below BEPS limitations, he says.

Daylighting used in a new marketplace.

"Task-ambient lighting may seem like an obvious concept," Gillette concedes, "but applying those concepts to real design is difficult. Lighting doesn't just 'happen'—there must be a lot of careful planning." Supporting the case that task-ambient lighting application isn't easy, one need only look at most offices where corners of rooms or ends of hallways—places usually not needing bright lighting—are bathed in bright lights—wasting energy.

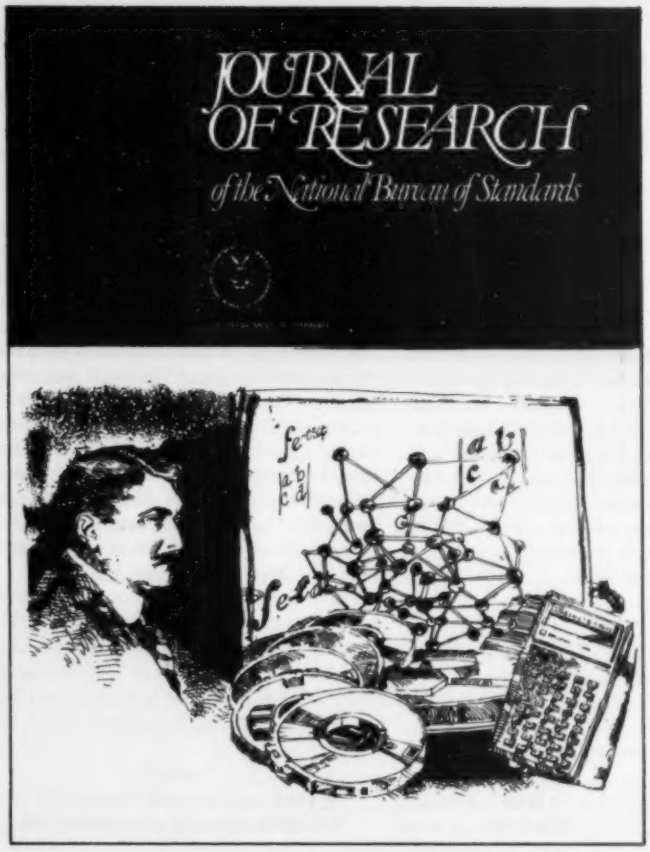
Wasted lights or not, what is the future of daylighting? Gillette sees a growing interest in its use. As an architectural engineer—with training to be registered as both an architect and engineer—Gillette is sensitive to the needs and concerns of these two often disparate disciplines. Architects already are incorporating daylighting designs into aesthetically pleasing buildings, Gillette says.

However, American interest in daylighting has lagged far behind Europe and, to a lesser extent, Japan. "Years ago, almost all research on daylighting was from Europe," Gillette says. "Maybe it's because they have more cloudy days (good, diffuse light) or perhaps it's because Europe has always been short of energy."

Gillette is leaving the determination of daylighting's payback-cost benefits to the economists. However, he feels the design and construction costs of daylighting designs can be kept at minimal levels. The use of "passive daylighting" designs—those that do not use mechanical devices that "chase" the sun, or other gadgetry—is gaining favor among builders and architects.

"The cost of daylighting," Gillette points out, "can be a few switches and extra windows or it can be very complicated and costly. Often the simple designs can be the most effective and energy saving."

With rapidly escalating utility rates in this country, daylighting and other energy conserving techniques will undoubtedly garner support, and soon most Americans will understand what Gillette means when he says: "Daylighting is a way to save energy by using it." □



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- Note: The Journal was formerly published in two sections: Section A "Physics and Chemistry" and Section B "Mathematical Sciences."

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CHILL-CAST STAINLESS STEEL STANDARD REFERENCE MATERIALS

by Stan Lichtenstein

Culminating a cooperative program among industry, the Steel Founders' Society of America, the American Society for Testing and Materials, and NBS, the Bureau's Office of Standard Reference Materials has certified four chill-cast stainless steel SRM's for their chemical composition.

Designated as C1151 (23Cr-7Ni), C1152 (18Cr-11Ni), C1153 (17Cr-9Ni), and C1154 (19Cr-13Ni), these SRM's are issued in the form of disks approximately 32 mm (1¼ in) in diameter and 19 mm (¾ in) thick primarily for use in calibration using optical emission and x-ray spectrometric methods of analysis.

Lichtenstein is a writer and public information specialist in the NBS Public Information Division.

By applying the "benchmark" concept, NBS researchers have tailored compositions of the SRM's to provide concentration ranges for the elements normally specified in most austenitic stainless steels of the typical 18Cr-8Ni types. The elements certified are: carbon, manganese, phosphorus, sulfur, silicon, copper, nickel, chromium, vanadium, molybdenum, cobalt, and lead (see table). To enhance the utility of the four SRM's, a concentration range has been provided for 17 additional elements, some of which are expected to be certified at a later date.

Specimens were chill-cast by a rapid unidirectional solidification technique at Esco Corporation, Portland, Oregon. Testing and analyses were carried out in the NBS Center for Analytical Chemistry. Cooperative analyses for certification, under the auspices of the ASTM-NBS Research Associate Program, were performed in the following laboratories: Allegheny Ludlum Steel Corporation, Armco Steel Corporation Research Center, Bethlehem Steel Corporation, Carpenter Technology Corporation, Cyclops Corporation, Foster-Wheeler Development Corporation, and Republic Steel Corporation.

For further information, contact the Office of Standard Reference Materials, B311 Chemistry Building, NBS, Washington, DC 20234.

The following table gives the values for four chill-cast stainless steel SRM's

SRM No.	C1151	C1152	C1153	C1154
Designation	23Cr-7Ni	18Cr-11Ni	17Cr-9Ni	19Cr-13Ni
Element	**Percentage by Weight**			
Carbon	0.039	0.148	0.264	0.086
Manganese	2.50	0.96	0.50	1.42
Phosphorus	0.017	0.021	0.030	0.06
Sulfur	0.038	0.0064	0.018	0.053
Silicon	0.38	0.80	1.07	0.50
Copper	0.418	0.102	0.23	0.40
Nickel	7.29	10.88	8.77	12.92
Chromium	22.70	17.81	16.69	19.06
Vanadium	0.037	0.030	0.18	0.135
Molybdenum	0.80	0.43	0.24	0.07
Cobalt	0.032	0.22	0.127	0.38
Lead	0.0039	0.0047	0.0054	0.0178

The value listed for a certified constituent is the ***present best estimate*** of the "true" value based on the results of the analytical program for certification. The individual certificates of analysis list the "estimated uncertainties" associated with the certified values.

NEW SHALE OIL REFERENCE MATERIAL TO IMPROVE ENVIRONMENTAL MEASUREMENTS

In response to recent concern over the environmental impact of alternative fuels, the National Bureau of Standards has issued a new shale oil Standard Reference Material (SRM 1580) with certified concentration values for five organic pollutants. The new SRM should greatly improve the accuracy of trace level measurements of environmentally important organic compounds found in shale oil, tar sands, liquefied coal and crude petroleum.

The issuance of this SRM, which was requested and partially funded by the Department of Energy's Office of Health and Environmental Research, follows several years of research at NBS to develop the analytical methods needed for measuring these types of compounds with sufficient accuracy. The methods developed for certification of this reference material combine the use of classical acid-base extraction, high-performance liquid chromatography, gas chromatography, and mass spectrometry.

Although techniques for quantitative trace inorganic analysis have existed for a number of years, the relatively new area of quantitative trace level organic analysis has been limited by a dearth of appropriate methods and by the complexity of organic materials. Trace level organic analysis often requires that a particular compound be isolated and quantified from a matrix or background of hundreds of thousands of other substances.

Consequently, there has been a lack of baseline reference data and standardized methodologies available to research laboratories equipped to measure organic pollutants. In a recent NBS study of nine laboratories under contract to the Department of Energy, concentrations reported for trace level amounts of pyrene and fluoranthene, in identical samples of shale oil, varied by about 600 percent from high to low values.

The use of quality assurance standards or SRM's to improve the accuracy of analytical measurements has been well documented. With certified materials to serve as calibration samples, analytical instruments can be adjusted to assure that all measurements of a given compound are compared with a common baseline.

In addition, the new SRM should help health scientists, process control engineers and regulatory officials to establish valid methodologies for measuring trace organic pollutants at each stage of fuel production and use. The development of such methodologies is of particular importance for organic compounds identified by the Environmental Protection Agency (EPA) as "priority pollutants."

A Certificate of Analysis is provided with each sample of shale oil (SRM 1580), specifying concentration values for phenol, o-cresol, fluoranthene, pyrene, benzo(e)pyrene, and benzo(a)pyrene. The various methods used by researchers in the NBS Organic Analytical Research Division to obtain these values show agreement at the 95 percent confidence level. Non-certified values for p-cresol, m-cresol, 2,5 dimethylphenol, and pyrene are reported for information only.

The shale oil used to make the certified samples was provided by the Laramie Energy Technology Center, Laramie, Wyoming. Further processing was provided by the Oak Ridge National Laboratory, Oak Ridge, Tennessee, where the shale oil was centrifuged to separate water and sludge before shipment to NBS.

SRM 1580 is available for $141 per unit of five 2-mL ampoules. For further information, contact the Office of Standard Reference Materials, B311 Chemistry Building, NBS, Washington, DC 20234.

Table 1
Certified Values of Organic Constituents

Compound	Concentration (μg/g)[a]
Fluoranthene	54 ± 10
Benzo[a]pyrene	21 ± 6
Benzo[e]pyrene	18 ± 8
Phenol	407 ± 50
o-Cresol	385 ± 50

[a] The estimated uncertainty listed for a constituent is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material inhomogeneity. The estimated uncertainty is intended to correspond to approximately 95% confidence limits.

Table 2
Non-Certified Values of Organic Compounds in Shale Oil

Compound	Concentration (μg/g)
p-Cresol	(270)[a]
m-Cresol	(330)[a]
2,5-Dimethylphenol	(320)[a]
Pyrene	(100)[b]

[a] Acid base extraction-GC analysis
[b] Direct injection-GC/MS analysis

NOTE: The values shown in this table are not certified because they are not based on the results of two independent methods. These values are included for information only.

Near-Field Measurements, page 14
Safer X-Ray Exams, page 16
XNDM, page 18

PLANAR NEAR-FIELD MEASUREMENTS ON A COMPACT RANGE

NBS scientists in the Electromagnetic Fields Division in Boulder, Colo., have shown that planar near-field measurements are practical and valuable in aligning and evaluating compact ranges used for antenna and radar cross-section measurements. Compact ranges provide a method for simulating, in a relatively small volume, plane wave conditions otherwise obtainable only on large far-field ranges, requiring linear distances typically in excess of one kilometer. In work contracted by the Air Force, they were able to extend the frequency range for such measurements up to 54.75 GHz, almost double the previous frequency ceiling. The ultimate goal is a frequency of 100 GHz.

Andrew G. Repjar and Douglas P. Kremer, Electromagnetic Fields Division, 4085 Radio Building, 303/497-5703.

Significant progress in recent years has been made on planar near-field measurements for antenna calibrations.[1] Such measurements are also useful in the alignment and evaluation of compact ranges because they provide more information than a limited number of analog plots in one dimension. Contour plots of amplitude and phase data, obtained from more complete two-dimensional measurements, locate precisely and accurately the sources of problems in the range reflector, with phase contour plots more useful as diagnostic tools.

For the compact range under test, the goal was to provide an approximate plane wave illumination over a measurement zone 120 cm square with less than 0.5 dB amplitude variation and less than 10 degrees phase variation at any frequency in the 12 GHz to 100 GHz range. The results of the planar near-field measurements were intended to determine if the goal could be achieved.

A precision reflector is one of the most critical factors in compact range design.[2] The particular range under test utilizes a portion (16 panels) of a precision 10-meter diameter reflecting surface, originally part of a prototype telescope for millimeter and submillimeter astronomy.[3] Each hexagonal panel has a surface accuracy of about 50 μm rms. Since the reflector support frame can be disassembled and reassembled and the panels reattached, the original parabolic surface accuracy can be obtained by adjusting 24 panel-support screws.

The parabolic reflecting surface, approximately 396 cm high and 475 cm wide, was mounted on the azimuth over elevation rotator at the NBS near-field facility in Boulder (see figure 1). In this configuration, the rotator was used to align the reflector with its axis normal to the plane of the scanner, and then the scanner was used to measure the field uniformity in a plane. Scalar feeds, designed to satisfy the 0.5 db amplitude variation specification, illuminated the reflecting surface, and planar near-field measurements were conducted at 18.0 GHz and 54.75 GHz. Horns were used for probes in the planar scanner. They were chosen for the alignment and reflector evaluation because, due to their narrower beamwidths, when compared with the beamwidths of open-ended waveguide probes, they attenuate variations caused by edge diffraction and feed spillover and focus on the data that show reflector surface errors.

Alignment of the compact range requires measuring the electromagnetic field, both amplitude and phase, in a zone approximately 150 cm behind the feed. Since a planar wavefront is desired in the test zone, it is advantageous for the measurement plane of the planar near-field scanner to coincide with a measurement plane of the test zone. First, the nominal axis of the reflector is set parallel to the normal of the scanner plane and the feed is positioned at the nominal focal point of the reflector. Then, in small increments, the feed is translated in x and rotated in azimuth, and the reflector is rotated in azimuth for maximum symmetry in x for both amplitude and phase plots in the *entire* measurement plane of the near-field scanner. Then, again in small increments, the feed is translated in z until the phase measurements are nearly constant in x.

[1] *A. C. Newell and M. L. Crawford, "Planar Near-Field Measurements on High Performance Array Antennas." Report NBSIR 74-380, available from the authors, Electromagnetic Fields Division, National Bureau of Standards, Boulder CO 80303.*

[2] *D. W. Hess, F. G. Willwerth, and R. C. Johnson, "Compact Range Improvements and Performance at 30 GHz." Digest of International Symposium, IEEE Antennas and Propagation Society, 20-22 June 1977, Stanford University.*

[3] *R. B. Leighton, "A 10-Meter Telescope for Millimeter Astronomy." Technical Report for NSF, California Institute of Technology, May 1978.*

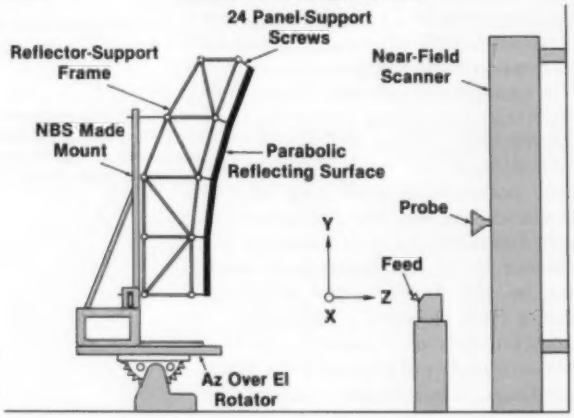

Figure 1—*A schematic of the NBS near-field measurement facility showing the coordinate system.*

The reflector is then rotated in elevation and the feed is adjusted in y and elevation angle, all in small increments, until the phase is nearly constant in y. Final adjustments can then be made to optimize all the above conditions simultaneously.

After the initial compact range alignment, contour plots of amplitude and phase were obtained from the complete two-dimensional data spaced 2.54 cm both in x and y, (figure 2). The overlaying of the reflector diagram onto the phase plot makes it apparent that the errors are in the vicinity of a specific support screw and result from reassembly of the reflector. However, since all support screws are adjustable, necessary adjustments can be made. The final amplitude and phase contour plots are shown in figures 3 and 4, respectively.

At 54.75 GHz, the phase contours varied more rapidly, by a factor of approximately 3, compared to those obtained at 18 GHz. Minor adjustments were made for a small number of support screws to further improve the overall compact range performance.

This measurement program showed that planar near-field measurements are indeed practical and valuable in aligning and evaluating compact ranges. In addition, the planar technique provides a convenient way to measure cross polarization levels precisely and accurately. It will only be mentioned here that cross component levels, on the order of 28 dB and 33 dB below the main component, were measured in the 120 cm measurement plane of the test zone at 18.0 GHz and 54.75 GHz, respectively.

Future work, both analytical and experimental, needs to be done on compact range evaluations. For example, experimental compact range studies should include other probes such as the broad-beam open-ended waveguide, which, due to its broader beamwidth (when compared to the beamwidth of a horn), does not attenuate variations caused by edge diffraction and feed spillover. Some results have been obtained for this case.

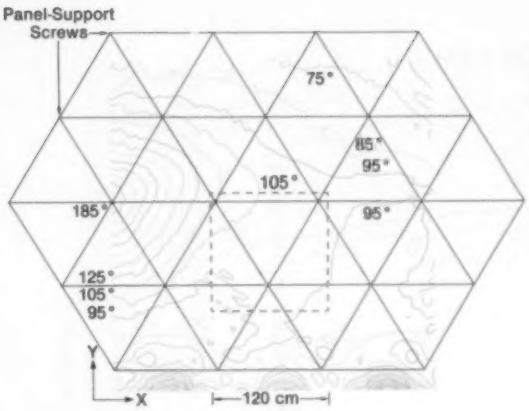

Figure 2—*A contour plot showing phase at a frequency of 18 GHz. The diamond-shaped grids represent the reflector support overlay and the dotted line represents the 120 cm square measurement zone. Note the unexpected concentric phase contours at the left center positions. This indicates a need for a panel-support screw adjustment.*

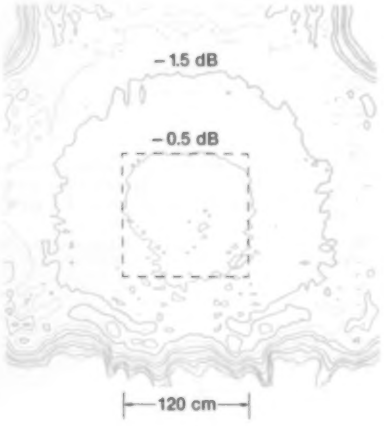

Figure 3—*The final amplitude contour plot at a frequency of 18 GHz using a horn probe and with one panel-support screw adjusted.*

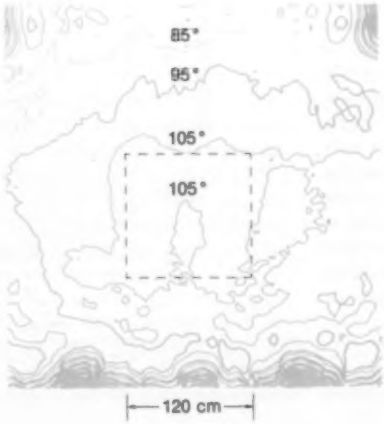

Figure 4—*The final phase contour plot at a frequency of 18 GHz using a horn probe and with one panel-support screw adjusted.*

TOWARD SAFER MEDICAL X-RAY EXAMS

Medical x-ray examinations provide the major source of radiation exposure to the population in this country. Therefore, any reduction in this exposure would have a significant impact in reducing adverse effects of radiation on the general health of the population. An analysis by NBS scientists of the dependence of image information content on x-ray exposure in medical diagnostic x-ray examinations indicates that by using image processing techniques, modified x-ray spectra, and more sensitive x-ray imaging systems, it is possible to reduce these exposures without losing the visual image information that is needed by the radiologist.

J. W. Motz and M. Danos, Radiation Physics Division, C214 Radiation Physics Building, 301/921-2201.

How is it possible to reduce x-ray exposures without reducing the diagnostic information that appears in visual form in present-day radiographs? This possibility seems paradoxical, since an exposure reduction is always accompanied by a loss of image information. However, our study indicates that only a fraction of the image information content in x-ray films is visually detected by the radiologist. Accordingly, it is possible to reduce the exposure without loss of the visible information, provided that all of the image information contained on the film (or other image storage system) can be made visible. This can now be achieved with state-of-the-art image processing techniques. In fact, the exposure for a particular diagnostic examination can be reduced to a theoretical minimum value without loss of the information that is presently visible on film. Such a lower limit exists because of the statistical noise associated with the quantum nature of x rays.

We have estimated the minimum exposures required for particular cases in diagnostic radiology from a theoretical

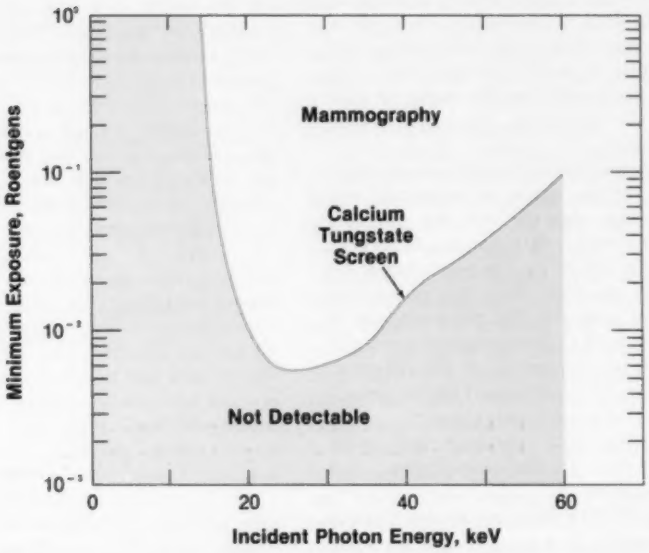

Figure 1—*Minimum x-ray exposure theoretically required in mammography for the detection of a tissue calcification sphere (0.5 mm diameter) embedded in 5 cm tissue with a calcium tungstate screen for detecting x rays and with no x-ray anti-scatter grid.*

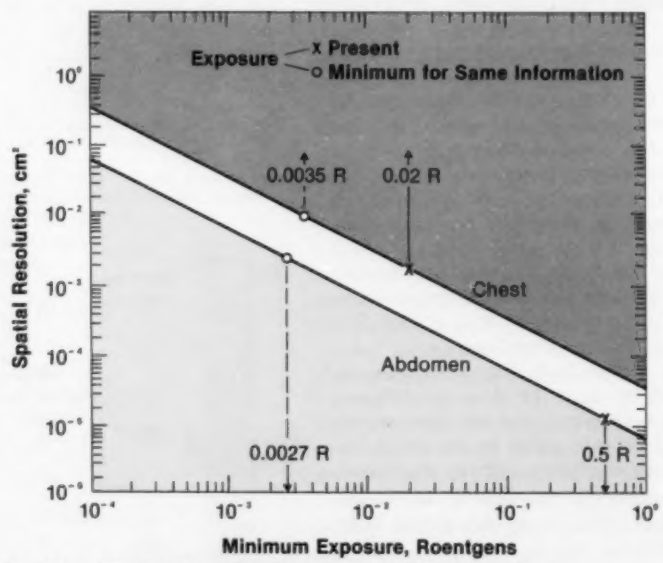

Figure 2—*Dependence of the attainable resolution area (cm²) on the patient exposure for x-ray exams of the chest and of the abdomen with barium contrast material. The average present day exposures and the theoretical lower exposure limit for the detection of the chest and abdominal structures are indicated by x and o, respectively.*

relationship between the patient exposure and the image information content. Results were obtained for a few types of radiological examinations.*

First, we consider the radiological examination for breast cancer (mammography), which in a simulated structure requires the detection of 0.5 mm diameter calcification spheres embedded in 5 cm compressed tissue. Present day mammography exposures for achieving optimum image visibility of such a structure on film are approximately one roentgen. These exposures are generally required with low-energy x rays ($\leqslant$20 keV) and with calcium tungstate screen-film imaging systems in which the x rays are detected by the screen and the image is stored on the film. However, the data in figure 1, which give minimum exposures required for the detection of such calcium spheres at different x-ray energies, indicate that it may be possible to obtain the same visible image information with patient exposures that are from one to two orders of magnitude smaller than one roentgen, if the x-ray spectrum is confined to an energy spread of approximately $\pm$10 keV in the region of 30 keV and if image processing techniques are used to enhance the stored image.

Next, we consider structures of the chest (lung-tissue with a resolution area $\geqslant 10^{-2}$ cm^2) and of the abdomen (barium-tissue with a resolution area $\geqslant 2 \times 10^{-3}$ cm^2), which are presently detected with an average patient exposure of 0.02 and 0.5 roentgen, respectively. The data in figure 2 show that these structures can be visually detected with much lower respective exposures of 0.004 and 0.003 roentgen, provided image processing techniques are used to enhance the stored image.

With the conventional screen-film imaging systems used in present day radiological examinations, the exposure reductions described above would produce a radiograph with an image that would be barely or not at all visible. Therefore, such an exposure reduction would require a more sensitive imaging system, which would also have the capability of employing image enhancement techniques.

An example of such a system is an x-ray image intensifier optically coupled to a TV camera, in which the video signal passes to an analog-to-digital converter and is then stored on a disc. With such a system, the stored image can be displayed on a TV monitor with any desired type of image processing, such as contrast or edge enhancement.

The above application of digital imaging systems to radiology requires knowledge of the information content and the corresponding image storage requirements for x-ray pictures. As shown in figure 3, we have determined the maximum number of bits per cm^2 required for the storage of x-ray images as a function of the x-ray exposure and the desired spatial resolution at two x-ray energies (20 keV and 50 keV) in the region used in medical radiology.† We expect these data to provide the basis for developing improved radiological systems that will permit either extraction of more image information than is currently attainable for a given x-ray exposure or reduction of x-ray exposure for a given image information content.

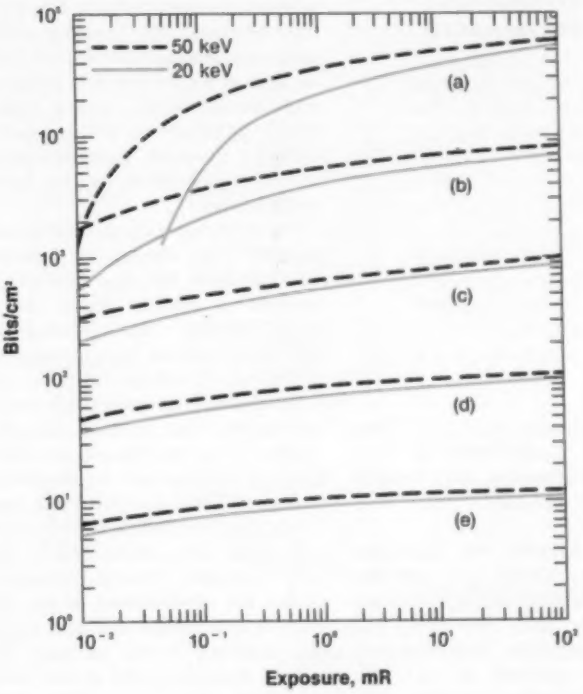

Figure 3—*Dependence of the number of bits per cm² on the x-ray exposure at the image plane for x-ray energies of 20 keV and 50 keV, and for different spatial resolutions where the area (in cm²) of the spatial resolution element is (a) 10^{-4}, (b) 10^{-3}, (c) 10^{-2}, (d) 10^{-1}, and (e) 10^{0}.*

*J. W. Motz and M. Danos, Medical Physics 5, 8 (1978).

†J. W. Motz and M. Danos, "Information Storage Requirements in Radiology," SPIE Proceedings, Vol. 206, Recent and Future Developments in Medical Imaging II, pp. 56-59 (1979).

XNDM: AN EXPERIMENTAL NETWORK DATA MANAGER

NBS researchers are exploring the development and use of an Experimental Network Data Manager (XNDM). Up to now, work on the XNDM suggests that it is a realistic and pragmatic approach to providing a uniform network view of data across heterogeneous data base management systems (DBMS). Continued work in developing access controls, semantic integrity, and more sophisticated translation capabilities will be necessary before the XNDM is a viable tool for the network user.

Stephen R. Kimbleton, Pearl S.-C. Wang, and Elizabeth N. Fong, Center for Computer Systems Engineering, B212 Technology Building, 301/921-2601.

In accessing different data base management systems (DBMS) in a computer network, the user must deal with a variety of data models, data structures, data manipulation languages, and computer systems. One approach to ease the burden on the user is to convert the existing varied DBMS to a single DBMS with one data structure and one data manipulation language. The resulting distributed data base management system (DDBMS) appears to the user as one logical system implemented across several host computers. Drawbacks to this approach, however, are the costs associated with converting existing DBMS and data bases to a single system.

An alternative approach being explored by NBS is to develop an Experimental Network Data Manager (XNDM) which provides a uniform global user view across existing heterogeneous DBMS. While the software requirements for the XNDM may be substantial, its use appears to be attractive for information processing applications that involve unpredictable and non-recurrent requests for data. The basic relationship between the XNDM and individual DBMS is illustrated in figure 1.

The designed XNDM consists of a unified global data model and a network data language. Several considerations guided the development of the XNDM. First, its data model and data manipulation language should be easy for the user to understand and should minimize procedural and navigational requirements (that is, the extent to which the user must specify *how* rather than *what* data are to be retrieved or updated, and the need for the user to specify interrelationships among data elements). Second, the network user should be assisted to ensure that queries and updates are meaningful. Third, the local DBMS should be provided with relatively tight guarantees that the user of the network will not be able to affect that network's operations adversely through ignorance or intent.

A relational data model was selected for the XNDM because it was simple to understand. Tables were chosen as the basic mechanism for representing the data. This technique presents a common view of the data to the network user and requires a means for mapping from this common view to the target systems. The data available to the XNDM do not have to include all of the data in a local DBMS. We can use only that data which is considered to be of common interest and which management of the local DBMS is willing to make available to the network user.

The Experimental Network Data Language (XNDL), designed for the XNDM, consists of three major components: Experimental Network Data Manipulation Language (XNDML), Experimental Network Data Control Language (XNDCL), and Experimental Network Data Definition Language (XNDDL).

The language chosen for the XNDML basic framework is SEQUEL, with extensions to meet the need for specifying the location of the target data base. The target SEQUEL is an existing data manipulation language that is table-based and has been tested for ease of use. The six major categories of the XNDML query commands are: C1 SELECT (columns); C2 SELECT . . . . WHERE (rows); C3 PARTITION; C4 SET OPERATIONS; C5 AGGREGATION; C6 COMPOSITION. SEQUEL sorting functions were eliminated because they add little to demonstrating the feasibility of the XNDM and can be expensive consumers of processing time on the host containing the local DBMS. The SEQUEL subset of XNDML can be

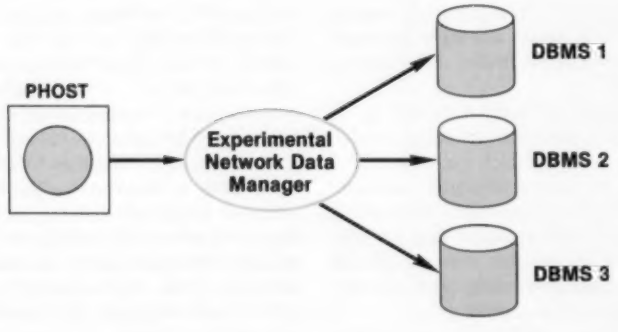

Figure 1—*XNDM interface between user program and multiple remote DBMS.*

extended to meet the need for specifying the target data base.

A system is being developed to ensure that meaningful queries and updates are provided. This Semantic Integrity System (SIS) is especially important to the development of the XNDM because managers of local DBMS will want to be assured that remote users will not affect the integrity of their individual DBMS. Although work on the XNDM Semantic Integrity System is in its preliminary stages, our observations show that semantic integrity can be expressed at the network level through the table-based data model. The facility available has some advantages: (i) it permits specification of data bases; (ii) it allows specification of the time at which the assertion is to be enforced; and (iii) it permits actions to be taken when integrity assertions are not satisfied.

To assure that the network user does not violate the security requirements of the local DBMS, the XNDM provides control mechanisms for both discretionary and non-discretionary access. Discretionary access control mechanisms permit user-directed controlled sharing of information, while non-discretionary access control mechanisms support organizational constraints on the sharing of information. The XNDM employs a lattice security model to check that discretionary grants do not conflict with non-discretionary controls.

The translation technology required for the XNDM is unique because it is a real-time, on-line process and is dependent upon both source and target data structures. Translation is required to convert XNDL into each target local DBMS language. Currently, translation has been implemented only for the query portion of the XNDML for two target DMBS—for a relational calculus system and a system similar to the CODASYL* approach.

The translation process (XNQL) is segmented into five major phases as shown in figure 2. The complex semantic manipulations required for translation are achieved by means of step-by-step transformations of an appropriately chosen internal representation of the input text. We have chosen a tree as the intermediate representation because of the requirement for flexibility in handling a wide range of target data manipulation languages and data structures.

Each transformation takes us somewhat closer to the actual statements of the target data manipulation language. This is done either by changing the original form of the input text to uncover the underlying "basic structure" of the query tree that characterizes the system-independent organization of queries, or by reshaping the basic tree to incorporate the surface structure of the target language. This approach reduces the overall translator complexity and supports a simple, consistent, modular design.

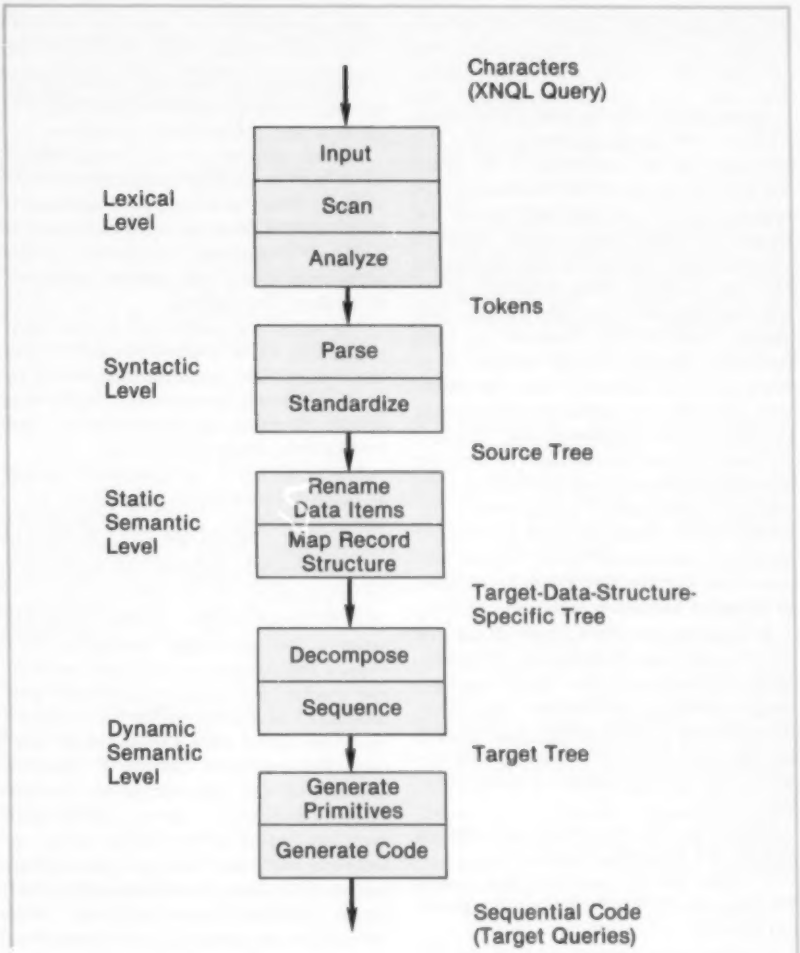

Figure 2—*The XNQL translator as a tree transformer.*

*A data structure and access language developed by the Conference on Data Systems and Languages.

CONFERENCES

For general information on NBS conferences, contact JoAnn Lorden, NBS Public Information Division, Washington, DC 20234, 301/921-2721.

REFERENCE MATERIALS FOR ORGANIC NUTRIENT MEASUREMENT WORKSHOP

A workshop will be held October 23, 1980, at NBS in Gaithersburg, Md. The objective of this workshop is to assess the state-of-the-art of the measurement of organic nutrients in food matrices for the purpose of developing a sound rationale for preparing suitable Standard Reference Materials (SRM's). These proposed SRM's will complement the SRM's which are already certified for elements in food matrices. The aim of this meeting is to bring together scientists from the industrial, research, and regulatory communities to discuss the problems and propose strategies for the development of accurate Standard Reference Materials and accurate and precise methods of measurement. The results of this workshop will be used to develop a prioritized list of organic nutrients and suitable matrices to be certified as Standard Reference Materials.

In order to provide a timely document on this vital area in analytical chemistry, rapid publication of the Workshop Recommendations is anticipated. The workshop will consist of a series of discussion groups to assess which matrices and nutrients are most amenable to standardization.

Objectives of the workshops are to address the following questions:

A. What are the matrices that confer the greatest stability to the specific group of nutrients?

B. What measurement methods are believed to be most accurate and precise?

C. What is an appropriate priority list for preparing Standard Reference Materials for the organic nutrients addressed?

A report will be prepared by the Organizing Committee, Workshop Chairpersons and Rapporteurs on the results of the individual workshop sessions. A priority list of nutrients and matrices to be evaluated for SRM's will be prepared.

For further information contact: Dr. Sam Margolis, A367 Chemistry Building, NBS, 301/921-2867.

INVENTORS' WORKSHOP SERIES CONTINUES

Workshops in five U.S. cities are intended to help inventors in those vicinities develop and market their inventions.

Special emphasis is on energy-related ideas, but the program is directed at all inventors. These workshops are sponsored by DOE, NBS, and the American Association of Engineering Societies, which represents nearly one million engineers throughout the nation.

The series was kicked off in San Francisco, May 17-18, and continued in Boston, June 20-21. The next session will be held in Atlanta, October 3-4; Dallas-Fort Worth, October 31-November 1; and Philadelphia, November 21-22.

The conferences are specifically aimed at helping inventors improve their innovative capabilities, particularly those inventors who are working independently or within small companies of fewer than 20 employees.

A principal theme of the workshop series is "to encourage innovative individuals and companies to invent, develop, and market new energy technologies and products," according to Patrick J. Donohue, Director of the DOE Invention Support Division and George P. Lewett, Director of the NBS Office of Energy-Related Inventions. Lewett added that inventors "need to have better access to technical and other data and have opportunities to increase their knowledge of all elements in the innovative process. The workshops are tailored to fit those important needs."

Commenting on the role of the American Association of Engineering Societies in the workshop series, Carl Frey, executive director of the association said: "Professional engineering societies of the United States represent a vast storehouse of technical and engineering knowledge of value in the generation of innovative ideas. This cooperative project has great potential benefit for the nation in sectors where technology plays an essential role."

At the Federal level, the NBS/DOE Energy-Related Inventions Program addresses important needs by assisting individual inventors in evaluating, developing, and then marketing their energy-related ideas. For promising inventions, the NBS/DOE program is prepared to offer one-time help—usually amounting to a year of financial and technical backing—with assistance to be negotiated directly with the inventor or small business.

All five workshops feature lectures and panel discussions on topics such as turning ideas into inventions, patenting and protection, licensing and selling inventions, and starting up new businesses. Inventors and small business representatives who attend the workshops are also advised on how to obtain consultative services and financial assistance from both public and private sources.

Information on sources of technical and business data, government programs which provide assistance for inventors, and books and publications of particular interest to inventors will be on display at each workshop.

In the past four years, 135 ideas have been recommended to DOE from a total of almost 7000 that passed the rigorous evaluation process by NBS. Some of the invention "success stories" under the program are a simplified, energy-saving new technology for concrete building construction, an efficient and economical solar heat-exchanger that unrolls and lies flat like a floormat, a water heater that uses less fuel, and a device that reuses the exhaust heat from cooking stoves.

Further information on the workshops may be obtained by writing or calling National Innovation Workshops, Box 158, Rheem Valley, CA 94750, 415/376-7541.

CONFERENCE CALENDAR

September 18-19
SYMPOSIUM ON INFORMATION RESOURCE MANAGEMENT (IRM), NBS, Gaithersburg, MD; sponsored by NBS and OPM; contact: Sara R. Torrence, A640 Administration Building, 301/921-2721.

September 22-24
NATIONAL CONFERENCE OF STANDARDS LABORATORIES, NBS, Gaithersburg, MD; sponsored by NBS and NCSL; contact: Brian Belanger, B362 Physics Building, 301/921-2805.

September 29-October 1
CERAMICS AS ARCHAEOLOGICAL MATERIAL, NBS, Gaithersburg, MD; sponsored by NBS and Smithsonian Institution; contact: Alan Franklin, A355 Materials Building, 301/921-2901.

October 6-7
REFRIGERATION FOR CRYOGENICS SENSOR AND ELECTRONICS SYSTEM, NBS, Boulder, CO; sponsored by the International Institute of Refrigeration Commission A 1/2, Office of Naval Research, Naval Research Laboratory, Cryogenic Engineering Conference, and NBS; contact: Sandy McCarthy, Room 1237, Electromagnetic Technology Division, 303/497-3988.

October 7-9
COAL CONVERSION, NBS, Gaithersburg, MD; sponsored by NBS and DOE; contact: Samuel Schneider, B308 Materials Building, 301/921-2894.

*October 20-21
INTERNATIONAL COUNCIL FOR BUILDING RESEARCH, STUDIES, AND DOCUMENTATION, NBS Gaithersburg, MD; sponsored by NBS and NSF; contact: Preston McNall, B114 Building Research Building, 301/921-3637.

October 22-24
FOURTH ANNUAL CONFERENCE ON FIRE RESEARCH, NBS, Gaithersburg, MD; sponsored by NBS; contact: Sonya Cherry, B258 Polymers Building, 301/921-3845.

October 23
WORKSHOP ON REFERENCE MATERIALS FOR ORGANIC NUTRIENT MEASUREMENT, NBS, Gaithersburg, MD; sponsored by NBS; contact: Dr. Sam Margolis, A367 Chemistry Building, 301/921-2867.

December 10
COMPUTER NETWORKING CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and IEEE; contact: Robert Toense, B226 Technology Building, 301/921-3516.

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*January 6-8
WORKSHOP ON PROPOSED NETWORK PROTOCOL STANDARDS, NBS, Gaithersburg, MD; sponsored by NBS; contact: Fran Nielsen, B212 Technology Building, 301/921-2601.

March 17-18
SECOND CONFERENCE ON CONSUMER PRODUCT STANDARDS, NBS, Gaithersburg, MD; sponsored by NBS and ASTM; contact: Walter Leight, 111 EM Building, 301/921-3750.

April 6-10
6TH INTERNATIONAL SYMPOSIUM ON NOISE IN PHYSICAL SYSTEMS, NBS, Gaithersburg, MD; sponsored by NBS and the Catholic University of America; contact: Robert J. Soulen, B128 Physics Building, 301/921-2018.

April 30-May 1
NATIONAL ROOFING TECHNOLOGY CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and NCRA; contact: Robert Mathey, B348 Building Research Building, 301/921-2629.

*June 1-3
6TH INTERNATIONAL SYMPOSIUM ON IMAGING AND ULTRASONIC TISSUE CHARACTERISTICS, NBS, Gaithersburg, MD; sponsored by NBS, NIH, IEEE, and AIUM; contact: Mel Linzer, A366 Materials Building, 301/921-2611.

June 8-12
SECOND INTERNATIONAL CONFERENCE ON PRECISION MEASUREMENTS AND FUNDAMENTAL CONSTANTS, NBS, Gaithersburg, MD; contact: Barry N. Taylor, B258 Metrology Building, 301/921-2701.

June 15-19
INTERNATIONAL JOINT CONFERENCE ON THERMOPHYSICAL PROPERTIES, NBS, Gaithersburg, MD; sponsored by NBS, ASME, and Purdue University; contact: A. Cezairliyan, Room 124 Hazards Building, 301/921-3687.

September 14-16
SECOND INTERNATIONAL CONFERENCE ON THE DURABILITY OF BUILDING MATERIALS AND COMPONENTS, NBS, Gaithersburg, MD; sponsored by NBS, ASTM, NRC of Canada, International Council for Building Research Studies and Documentation, International Union of Testing and Research Laboratories for Materials and Structures; contact: Geoffrey Frohnsdorff, B348 Technology Building, 301/921-3458.

*New Listings

PUBLICATIONS

NBS OPTICAL FIBER MEASUREMENT PUBLICATIONS

*Franzen, D. L., and Day, G. W., Measurement of Optical Fiber Bandwidth in the Time Domain, Nat. Bur. Stand. (U.S.), Tech. Note 1019, 72 pages (Feb. 1980) Stock No. 003-003-02161-0, $3.75 and Danielson, B. L., An Assessment of the Backscatter Technique as a Means for Estimating Loss in Optical Waveguides, Nat. Bur. Stand. (U.S.), Tech. Note 1018, 88 pages (Feb. 1980) Stock No. 003-003-02160-1, $3.75.**

The National Bureau of Standards has published two technical notes on optical fiber measurements. Both technical papers are from the Optical Electronic Metrology group of the NBS Center for Electronics and Electrical Engineering in Boulder, Colo.

Technical Note 1018, *An Assessment of the Backscatter Technique as a Means for Estimating Loss in Optical Waveguides,* by B. L. Danielson, employs computer modeling to describe the scattering and absorption loss properties of optical fibers. The computer simulation permits a comparison between the direct (insertion) method of measuring attenuation and several methods of estimating attenuation from analysis of backscatter data. Numerous examples are given of physical effects that can produce discrepancies in attenuation values calculated from backscatter signals.

The author also gives one experimental comparison between backscatter-derived and directly-measured attenuation values in step and graded-index optical waveguides. Finally, Danielson outlines conditions necessary for good agreement between direct and backscatter methods.

Technical Note 1019, *Measurement of Optical Fiber Bandwidth in the Time Domain,* by Douglas L. Franzen and Gordon W. Day, describes a system for determining optical fiber bandwidth from time domain measurements, with discussion of the overall system architecture, precision, and dynamic range, and typical experimental results.

A time domain measurement gives the frequency response of an optical fiber by analysis of output and input waveforms. The authors provide an analysis of the variables affecting the measurement and discuss such input-related topics as launching conditions, mode scramblers, and laser diode sources. Other topics include the evaluation of laser diode sources for near-field emission and chirping, a consideration of materials dispersion limits, and the evaluation of detectors for time response, linearity, and uniformity.

TOPICAL CONFERENCE ON BASIC OPTICAL PROPERTIES OF MATERIALS

Feldman, A., Basic Optical Properties of Materials Summaries of Papers, Nat. Bur. Stand. (U.S.), Spec. Publ. 574, 272 pages (May 1980) Stock No. 003-003-02173-3, $6.50.

A topical conference on Basic Optical Properties of Materials sponsored by the National Measurement Laboratory of NBS in cooperation with the Optical Society of America, held May 5-7, 1980, resulted in a published Proceedings as NBS Special Publication 574. It contains summaries of 62 papers presented at the conference. Presentations of the conference discuss the state-of-the-art in the measurement and theory of optical properties of materials of importance to advanced optical technology; that is, emphasis is on the science of optical materials in bulk, thin film, and fiber form rather than optical devices as such.

Topical areas covered, are varied—nonlinear optical properties, ultraviolet properties, infrared properties, graded index materials, inhomogeneous materials, thin films, optical fibers, planar optical waveguides, and external influences including piezo-optics, thermo-optics, and magneto-optics. Papers deal with many aspects of optical absorption, reflection or refraction caused by electronic and photon transitions in different regions of the optical spectrum and the way these processes are affected by external influences. A significant feature is the ever increasing variety of measurement methods for characterizing optical properties. For example, new techniques, such as integrated-optics guide wave methods and vacuum calorimetry, and highly refined older techniques, such as spectroscopic ellipsometry and differential reflectometry, demonstrate the large advances in characterizing dielectric and metallic thin films and surfaces. These results of optical materials research will be important for many technological applications such as communications, signal processing, solar energy conversion, laser fusion, chemical spectroscopy, and optical displays.

**Publications cited from this point on may be purchased at the listed price from the U.S. Government Printing Office, Washington, DC 20402 (foreign: add 25 percent). Microfiche copies are available from the National Technical Information Service, Springfield, VA 22161. For more complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, DC 20234.*

MIUS FEASIBILITY

Mitchell, D. J., MIUS Feasibility-Five Exploratory Studies, NBSIR 79-1787, for sale by the National Technical Information Service, Springfield, VA 22161, $11; order by #PB 80-154719.

Five exploratory studies evaluating the feasibility of Modular Integrated Utility Systems (MIUS) have been published by the National Bureau of Standards. The report is a summary of previously unpublished initial MIUS feasibility studies prepared by NBS with the National Aeronautics and Space Administration using comparative environmental and energy analyses as well as utility system design and cost analyses. It details the methods utilized to design and to evaluate MIUS and conventional utility systems for each project. The publication should aid city planners, engineers, economists, builders and environmentalists.

The MIUS program—sponsored by the Department of Housing and Urban Development—is devoted to the development and demonstration of the technical, economic, and institutional advantages of combining the systems for providing several or all utility services for a community. Utilities included in this program are electricity, heating and cooling, domestic hot water, water purification, waste water treatment, and solid waste processing.

The studies indicate little or no difference in the amount of environmental impact between a MIUS and conventional operation. A trend for significant MIUS energy savings relative to conventional utility service was demonstrated. Design and cost analysis conclusions varied significantly depending on individual conditions such as density, thermal loads, and the number of dwelling units served. Five housing projects serviced by MIUS were chosen at random for the study.

PUBLICATIONS LISTING

Building Technology

Knab, L. I., Yokel, F. Y., Galligan, W. L., Bendtsen, B. A., and Senft, J. F., A Study of Lumber Used for Bracing Trenches in the United States, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 122, 221 pages (Mar. 1980) Stock No. 003-003-02164-4, $6.

Yokel, F. Y., Tucker, R. L., and Reese, L. C., Soil Classification for Construction Practice in Shallow Trenching, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 121, 89 pages (Mar. 1980) Stock No. 003-003-02162-8, $3.75.

Health and Safety

Paffenbarger, G. C., Rupp, N. W., and Malmstedt, M., Organizations Engaged in Preparing Standards for Dental Materials and Therapeutic Agents with a List of Standards, Nat. Bur. Stand. (U.S.), Spec. Publ. 571, 55 pages (Apr. 1980) Stock No. 003-003-02163-6, $3.50.

Electronic Technology

Myers, D. R., Semiconductor Measurement Technology: Technical Impediments to a More Effective Utilization of Neutron Transmutation Doped Silicon for High-Power Device Fabrication, Nat. Bur. Stand. (U.S.), Spec. Publ., 400-60, 33 pages (May 1980) Stock No. 003-003-02181-4, $2.

Energy Conservation and Production

Marshall, H. E., and Ruegg, R. T., Energy Conservation in Building: An Economics Guidebook for Investment Decisions, Nat. Bur. Stand. (U.S.), Handb. 132, 149 pages (May 1980) Stock No. 003-003-02192-0, $5.

Engineering, Product, and Information Standards

Amer, P. D., Computer Science and Technology: Application of Measurement Criteria in the Selection of Interactive Computer Services, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-58, 90 pages (Apr. 1980) Stock No. 003-003-02174-1, $4.

Brodie, M. L., Computer Science and Technology: Data Abstraction, Database, and Conceptual Modelling: An Annotated Bibliography, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-59, 86 pages (May 1980) Stock No. 003-003-02179-2, $3.75.

Debelius, J. R., NBS Staff Participation in Outside Standards Activities, 1979 Highlights, Nat. Bur. Stand. (U.S.), Spec. Publ. 573, 64 pages (Mar. 1980) Stock No. 003-003-02176-8, $3.50.

Mamrak, S. A., Computer Science and Technology: Sizing Distributed Systems: Overview and Recommendations, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-60, 21 pages (May 1980) Stock No. 003-003-02190-3, $1.75.

Ruthberg, Z. G., Ed., Computer Science and Technology: Audit and Evaluation of Computer Security II: System Vulnerabilities and Controls. Proceedings of the NBS Invitational Workshop held at Miami Beach, Fla., Nov. 28-30, 1978, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-57, 210 pages (Apr. 1980) Stock No. 003-003-02178-6, $6.

I/O Channel Interface, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB) 60-1, 70 pages (1980).

Nuclear Physics and Radiation Technology

Seltzer, S., SHIELDOSE: A Computer Code for Space-Shielding Radiation Dose Calculations, Nat. Bur. Stand. (U.S.), Tech. Note 1116, 72 pages (May 1980) Stock No. 003-003-02172-5, $3.75.

Ehrlich, M., and Soares, C. G., A Thermoluminescence Dosimetry System for Use in a Survey of High-Energy Bremsstrahlung Dosimetry, Nat. Bur. Stand. (U.S.), Tech. Note 1119, 47 pages (May 1980) Stock No. 003-003-02180-6, $2.50.

Technology Incentives

Mulkey, M. A., and Weiss, R. G., Prospects for an OSHA/ETIP Project to Facilitate Technological Innovation, Nat. Bur. Stand. (U.S.), Tech. Note 1114, 49 pages (May 1980) Stock No. 003-003-02171-7, $3.25.

NEWS BRIEFS

NBS SEEKING LAW ENFORCEMENT OFFICERS' COMMENTS ON HANDGUNS. This is part of a project to develop a draft performance standard for revolvers intended for law enforcement use. Undertaken at the request of the Law Enforcement Assistance Administration, the project will involve development of performance requirements and test methods to assure officers of a reasonably acceptable level of safety and performance while providing law enforcement agencies with help in selecting handguns. Comments on experiences with handguns--either with particular models or general categories--should be communicated to Nicholas Calvano, EM 110, National Bureau of Standards, Washington, DC 20234.

COOPERATIVE TECHNOLOGY CENTERS. Proposed procedures for running a Cooperative Generic Technology Program have been announced by the Commerce Department. The new Program will provide an opportunity for government, industry, technical institutes, and universities to cooperate in the development of needed generic technology in cases where it is inappropriate for private sector firms to act alone. Cooperative centers will be established, with each center targeted on a technology that is involved in the processes of several industrial sectors with the potential for significant upgrading.

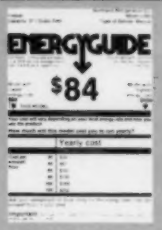
GEOLOGICAL DATA FOR NUCLEAR WASTE DISPOSAL SITES. The NBS Office of Standard Reference Data is coordinating a project to examine the existing geological data on four rock types of interest in selecting disposal sites for nuclear wastes. If the initial study determines that there are sufficient useful data available, the data then will be evaluated for accuracy and gathered in a convenient form for future use. The data will include physical properties of basalt, shale, tuff (a type of volcanic residue), and granite. Materials data centers at the U.S. Geological Survey and Purdue University will be involved in the preliminary study, which is funded by the Department of Energy's Office of Nuclear Waste Isolation.

RANDOM-FAULT TEST STRUCTURES. Researchers at NBS have developed a new series of random-fault test structures for integrated circuits. Like previous NBS test structures, the new structures are meant to be fabricated along with regular production devices to provide a means for determining the relative density of interconnect faults introduced in the production process. The new devices are designed for both pMOS and nMOS systems with self-aligned polysilicon gates and consist of step-coverage test structures with linewidths of 8, 4, 2, and 1 μm, thus covering most linewidths of interest up to and including VLSI technologies.

NATIONAL MEASUREMENT LABORATORY HIGHLIGHTS FOR 1979. A detailed description of over 40 significant research events at the National Measurement Laboratory (NML), the physical science research arm of NBS, has been published. The review of 1979 activities covers the broad range of NML research interests in the fields of physics, chemistry, and materials sciences. Each research highlight is illustrated with appropriate graphs and diagrams. Copies of the National Measurement Laboratory 1979 Technical Highlights (SP 572) are available for $4.25 from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Order by Stock No. 003-003-02203-07.

NEXT MONTH IN

DIMENSIONS/NBS



"Do not remove this label . . ." has a new significance when attached to a home appliance. September DIMENSIONS/NBS explains the purpose of the new energy efficiency rating labels.

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